

Claims

We claim

1. A computer-implemented method for invoking a sequence of operations,
5 the method comprising:

displaying a graphical user interface (GUI) of a first application, wherein the graphical user interface provides GUI access to a set of operations;

receiving user input to the graphical user interface to specify the sequence of operations; and

10 invoking execution of the specified sequence of operations from a second program external to the first application.

2. The method of claim 1, further comprising:

15 executing the sequence of operations under control of the first application in response to said invoking execution of the sequence of operations from the second program.

3. The method of claim 1, further comprising:

20 storing information representing the specified sequence of operations in a data structure in response to said receiving user input specifying the sequence of operations.

4. The method of claim 3,

wherein the information does not comprise programming language code.

25 5. The method of claim 3, wherein, in response to said invoking execution of the specified sequence of operations from a second program external to the first application, the first application is operable to:

access the information representing the sequence of operations to determine program instructions corresponding to operations in the sequence; and

30 execute the program instructions.

6. The method of claim 3,

wherein said receiving user input to the graphical user interface to specify the sequence of operations comprises receiving user input to the graphical user interface specifying parameter values for one or more operations in the sequence;

5 wherein said storing information representing the specified sequence of operations comprises storing the parameter values;

wherein the method further comprises executing software routines corresponding to operations in the sequence in response to said invoking execution of the specified sequence of operations;

10 wherein said executing comprises passing the parameter values to the software routines.

7. The method of claim 1, further comprising:

15 creating the second program, wherein the second program is operable to invoke the specified sequence of operations during execution of the second program.

8. The method of claim 7,

20 wherein said creating the second program comprises including source code in the second program for invoking execution of the sequence of operations.

9. The method of claim 8,

25 wherein the second program is a graphical program, wherein said including source code in the second program for invoking execution of the sequence of operations comprises:

including a first node in the graphical program, wherein the first node is operable to call the first application; and

configuring the first node with information identifying the sequence of operations.

30 10. The method of claim 1, wherein the second program is a graphical program, the method further comprising:

creating the graphical program, wherein the graphical program includes a node which is operable to invoke the specified sequence of operations during execution of the graphical program.

5 11. The method of claim 10,
 wherein the graphical program comprises a plurality of interconnected nodes that
visually indicate functionality of the graphical program.

10 12. The method of claim 10,
 wherein the graphical program is a graphical data flow program.

13. The method of claim 1, wherein the second program is a text-based program, the method further comprising:

15 creating the text-based program in a text-based programming environment,
 wherein the text-based program includes a call which is operable to invoke the specified
sequence of operations during execution of the text-based program.

20 14. The method of claim 1, further comprising:
 executing the second program;
 wherein said executing the second program comprises the second program
requesting the first application to execute the sequence of operations.

25 15. The method of claim 14, further comprising:
 the first application executing the sequence of operations synchronously with
respect to the second program.

30 16. The method of claim 14, further comprising:
 the first application executing the sequence of operations asynchronously with
respect to the second program.

17. The method of claim 1,

wherein said receiving user input to the graphical user interface to specify the sequence of operations does not include receiving user input specifying programming language code to implement the sequence of operations.

5 18. The method of claim 1, further comprising:
receiving user input to the graphical user interface for configuring one or more of
the operations in the sequence;
wherein, for each operation, said configuring the operation affects an action
which the operation is operable to perform.

10 19. The method of claim 18,
wherein said receiving user input to the graphical user interface for configuring
one or more of the operations in the sequence does not include receiving user input
specifying programming language code to configure the operations.

15 20. The method of claim 18, further comprising:
for each operation to be configured, displaying a graphical panel including
graphical user interface elements for setting properties of the operation and receiving user
input to the graphical panel to set one or more properties of the operation.

20 21. The method of claim 1,
wherein the graphical user interface provides GUI access to a set of operations
that includes one or more of: one or more motion control operations, one or more
machine vision operations, and one or more DAQ operations;
25 wherein said receiving user input to the graphical user interface to specify the
sequence of operations comprises receiving user input to the graphical user interface to
specify a sequence of operations including one or more of: one or more motion control
operations, one or more machine vision operations, and one or more DAQ operations.

30 22. The method of claim 1,

wherein the graphical user interface provides GUI access to a set of operations that includes two or more of: one or more motion control operations, one or more machine vision operations, and one or more DAQ operations;

wherein said receiving user input to the graphical user interface to specify the sequence of operations comprises receiving user input to the graphical user interface to specify a sequence of operations including two or more of: one or more motion control operations, one or more machine vision operations, and one or more DAQ operations.

23. The method of claim 1,

wherein the graphical user interface provides GUI access to a set of operations that includes one or more motion control operations, one or more machine vision operations, and one or more DAQ operations;

wherein said receiving user input to the graphical user interface to specify the sequence of operations comprises receiving user input to the graphical user interface to specify a sequence of operations including at least one motion control operation, at least one machine vision operation, and at least one DAQ operation.

24. The method of claim 1,

wherein the sequence of operations is operable during execution to perform one or more of:

control motion of a device;
analyze acquired images; and
acquire measurement data.

25. The method of claim 1,

wherein the sequence of operations is operable during execution to perform two or more of:

control motion of a device;
analyze acquired images; and
acquire measurement data.

26. The method of claim 1,
wherein the sequence of operations is operable during execution to:

control motion of a device;
analyze acquired images; and
acquire measurement data.

27. The method of claim 1,
wherein the sequence of operations is operable during execution to:

control a motion control device to move an object;
control an image acquisition device to acquire one or more images of the
object; and
control a data acquisition device to acquire measurement data of the
object.

28. A computer-implemented method for invoking a sequence of operations
that includes motion control, machine vision, and data acquisition (DAQ) functionality,
the method comprising:

displaying a graphical user interface (GUI) of a first application, wherein the
graphical user interface provides GUI access to a set of operations, wherein the set of
operations includes one or more motion control operations, one or more machine vision
operations, and one or more DAQ operations;

receiving user input to the graphical user interface specifying the sequence of
operations, wherein the specified sequence of operations includes at least one motion
control operation, at least one machine vision operation, and at least one DAQ operation;
and

invoking execution of the specified sequence of operations from a second
program external to the first application.

29. The method of claim 28, further comprising:

executing the sequence of operations under control of the first application in response to said invoking execution of the sequence of operations from the second program.

5 30. The method of claim 28, further comprising:
 storing information representing the specified sequence of operations in a data structure in response to said receiving user input specifying the sequence of operations.

10 31. The method of claim 30,
 wherein the information does not comprise programming language code.

15 32. The method of claim 30, wherein, in response to said invoking execution of the specified sequence of operations from a second program external to the first application, the first application is operable to:

 access the information representing the sequence of operations to determine program instructions corresponding to operations in the sequence; and
 execute the program instructions.

20 33. The method of claim 28, further comprising:
 creating the second program, wherein the second program is operable to invoke the specified sequence of operations during execution of the second program.

25 34. The method of claim 33,
 wherein said creating the second program comprises including source code in the second program for invoking execution of the sequence of operations.

30 35. The method of claim 34,
 wherein the second program is a graphical program, wherein said including source code in the second program for invoking execution of the sequence of operations comprises:

including a first node in the graphical program, wherein the first node is operable to call the first application; and
configuring the first node with information identifying the sequence of operations.

5 36. The method of claim 28, wherein the second program is a graphical program, the method further comprising:

 creating the graphical program, wherein the graphical program includes a node which is operable to invoke the specified sequence of operations during execution of the graphical program.

10 37. The method of claim 28, further comprising:
 executing the second program;

 wherein said executing the second program comprises the second program requesting the first application to execute the sequence of operations.

15 38. The method of claim 28,
 wherein said receiving user input to the graphical user interface specifying the sequence of operations does not include receiving user input specifying programming language code to implement the sequence of operations.

20 39. The method of claim 28,
 wherein the sequence of operations is operable during execution to perform one or more of:

 control motion of a device;
25 analyze acquired images; and
 acquire measurement data.

30 40. The method of claim 28,
 wherein the sequence of operations is operable during execution to perform two or more of:

 control motion of a device;

analyze acquired images; and
acquire measurement data.

41. The method of claim 28,
wherein the sequence of operations is operable during execution to:
control motion of a device;
analyze acquired images; and
acquire measurement data.

42. The method of claim 28,
wherein the sequence of operations is operable during execution to:
control a motion control device to move an object;
control an image acquisition device to acquire one or more images of the
object; and
control a data acquisition device to acquire measurement data of the
object.

43. A computer-implemented method for executing a sequence of operations,
the method comprising:
displaying a graphical user interface (GUI) of a first application, wherein the
graphical user interface provides GUI access to a set of operations;
receiving user input to the graphical user interface specifying the sequence of
operations;
creating a program, wherein the program is external to the first application,
wherein the program is configured to invoke the specified sequence of operations during
execution of the program; and
executing the program external to the first application, wherein said executing
includes invoking execution of the specified sequence of operations.

44. The method of claim 43, further comprising:

executing the sequence of operations under control of the first application in response to said invoking execution of the sequence of operations from the program.

5 45. A computer-implemented method for executing a sequence of operations that includes motion control, machine vision, and data acquisition (DAQ) functionality, the method comprising:

 displaying a graphical user interface (GUI) of a first application, wherein the graphical user interface provides GUI access to a set of operations, wherein the set of
10 operations includes one or more motion control operations, one or more machine vision operations, and one or more DAQ operations;

 receiving user input to the graphical user interface specifying the sequence of operations, wherein the specified sequence of operations implements at least one motion control operation, at least one machine vision operation, and at least one DAQ operation;

15 creating a program, wherein the program is external to the first application, wherein the program is configured to invoke the specified sequence of operations during execution of the program; and

 executing the program external to the first application, wherein said executing includes invoking execution of the specified sequence of operations.

20 46. The method of claim 45, further comprising:

 executing the sequence of operations under control of the first application in response to said invoking execution of the sequence of operations from the program.

25 47. A computer-implemented method for executing a sequence of operations, the method comprising:

 displaying a graphical user interface (GUI) of a prototyping application, wherein the graphical user interface provides GUI access to a set of operations;

30 receiving user input to the graphical user interface specifying the sequence of operations;

creating a software program using an application development environment application, wherein the application development environment application is different from the prototyping application, wherein the software program is configured to request the prototyping application to execute the specified sequence of operations during
5 execution of the software program; and

executing the software program independent of the prototyping application, wherein said executing includes requesting execution of the specified sequence of operations.

10 48. The method of claim 47, further comprising:
executing the sequence of operations under control of the prototyping application in response to the software program requesting execution of the sequence of operations.

15 49. A computer-implemented method for invoking a sequence of operations, the method comprising:
receiving user input to a first application specifying a desired sequence of operations;
recording the specified sequence of operations in a data structure maintained by
20 the first application;
creating an application program, wherein the application program is configured to invoke the specified sequence of operations during execution of the application program;
and

25 executing the application program external to the first application, wherein said executing includes invoking execution of the specified sequence of operations.

50. The method of claim 49,
wherein said receiving user input to the first application specifying the desired sequence of operations comprises receiving user input to the first application specifying a
30 sequence of operations that includes at least one motion control operation, at least one machine vision operation, and at least one DAQ operation.

51. The method of claim 49, further comprising:

displaying a graphical user interface (GUI) of the first application, wherein the graphical user interface provides GUI access to a set of operations;

wherein the user input is received to the GUI.

52. A computer-implemented method for invoking a prototype, the method comprising:

displaying a graphical user interface (GUI) of a first application, wherein the graphical user interface provides GUI access to a set of operations;

receiving user input to the graphical user interface specifying a desired sequence of operations, wherein the specified sequence of operations comprises the prototype; and

invoking execution of the prototype from a second program external to the first application.

53. A computer-implemented method for invoking a prototype that includes motion control, machine vision, and data acquisition (DAQ) functionality, the method comprising:

displaying a graphical user interface (GUI) of a first application, wherein the graphical user interface provides GUI access to a set of operations, wherein the set of operations includes one or more motion control operations, one or more machine vision operations, and one or more DAQ operations;

receiving user input to the graphical user interface specifying a desired sequence of operations, wherein the specified sequence of operations implements at least one motion control operation, at least one machine vision operation, and at least one DAQ operation, wherein the specified sequence of operations comprises the prototype; and

invoking execution of the prototype from a second program external to the first application.

54. A memory medium for invoking a sequence of operations, the memory medium comprising program instructions executable to:

display a graphical user interface (GUI) of a first application, wherein the graphical user interface provides GUI access to a set of operations;

receive user input to the graphical user interface specifying the sequence of operations; and

execute the specified sequence of operations in response to a request received from a second program external to the first application.

55. The memory medium of claim 54,

wherein the set of operations includes one or more motion control operations, one or more machine vision operations, and one or more DAQ operations;

wherein the specified sequence of operations includes at least one motion control operation, at least one machine vision operation, and at least one DAQ operation;

wherein said executing the specified sequence of operations comprises executing the at least one motion control operation, at least one machine vision operation, and at least one DAQ operation.

56. A system for invoking a sequence of operations, the system comprising:
a processor;

a memory storing program instructions associated with a first application and program instructions associated with a second program;

a display device;

wherein the processor is operable to execute the program instructions associated with the first application to:

display a graphical user interface (GUI) for the first application, wherein the graphical user interface provides GUI access to a set of operations;

receive user input to the graphical user interface specifying the sequence of operations; and

wherein the processor is operable to execute the program instructions associated with the second program to request execution of the specified sequence of operations by the first application.

5 57. The system of claim 56,
 wherein the processor is operable to execute the program instructions associated with the first application to execute the specified sequence of operations in response to said program instructions associated with the second program requesting execution of the specified sequence of operations.

10 58. The system of claim 56,
 wherein the set of operations includes one or more motion control operations, one or more machine vision operations, and one or more DAQ operations; and
 wherein the specified sequence of operations includes at least one motion control
15 operation, at least one machine vision operation, and at least one DAQ operation.